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THE NAVAJO COUNTRY*

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PART II. THE PEOPLE

KISANI AND NAVAJO

The discovery of native tribes in northern Arizona dates from 1540, when Don Pedro de Tovar and Juan de Padilla, cavalier and priest, were guided by men from Zuni to the "Province of Tusayan." They found there a "very intelligent people" living in villages and successfully carrying on agriculture. No account is given of another race, and not until 1629 is the Navajo tribe specifically mentioned in the Spanish chronicles. At the present time the country between Rio Puerco and Rio San Juan is in the hands of the Navajos; but included with the Navajo lands is an area set aside for the Hopis, the modern representatives of the ancient race whose long occupation is attested by innumerable ruins. That the modern pueblos and the ruined dwellings, ancient terraced fields, and abandoned burial grounds are the work of a single composite race is not questioned by Hopi or Navajo, and, following the Navajo custom, I find myself using the term "Kisani" for the people whose occupation of this region has been uninterrupted for probably a thousand years.

HOPi AND NAVAJO

Though living within the same area and forced by proximity to intermingle to a slight degree, the Hopis and Navajos maintain their independence and as tribes are strongly contrasted in culture and manner of life.

The Hopis are small of stature, but agile and wiry and built to endure hardship; they mature early and die young. In mental traits they have no superior among Indian tribes; they are excessively religious and their social code is elaborate and complex. They are peaceful, quiet, industrious and home-loving, not, it appears to me, as the result of superior wisdom, but rather in consequence of centuries of struggle with natural phenomena. Their eyes are

* Concluded from August *Bulletin*, pp. 561-577. For location of geographical features, consult map there published on p. 562. Figures 24, 25, 28 and 29 were drawn by Miss Gladys M. Wrigley, Research Assistant on the Society's staff.

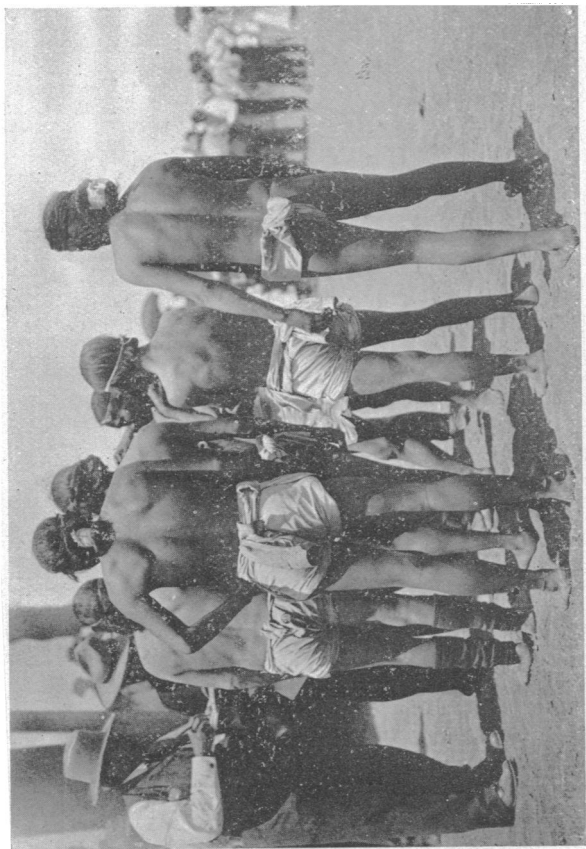
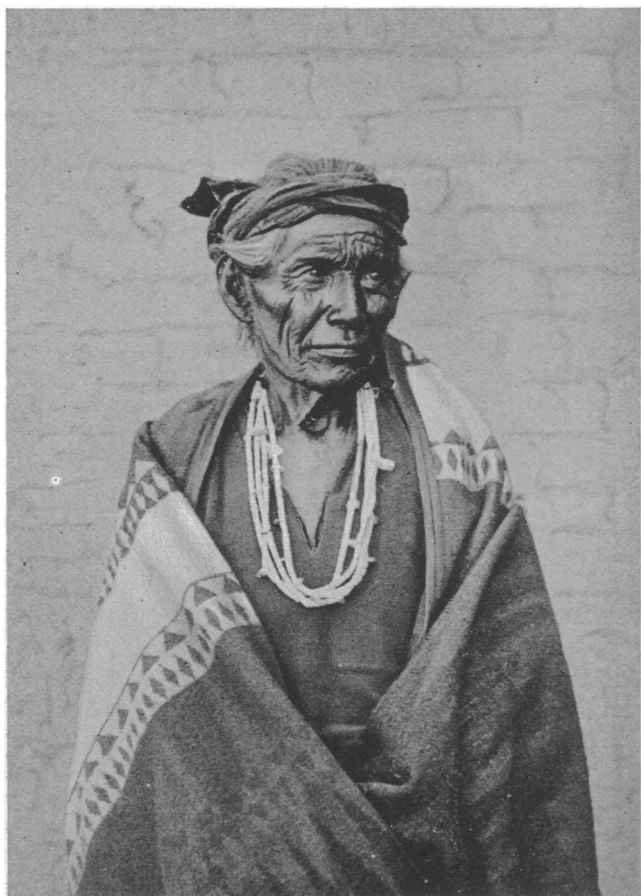
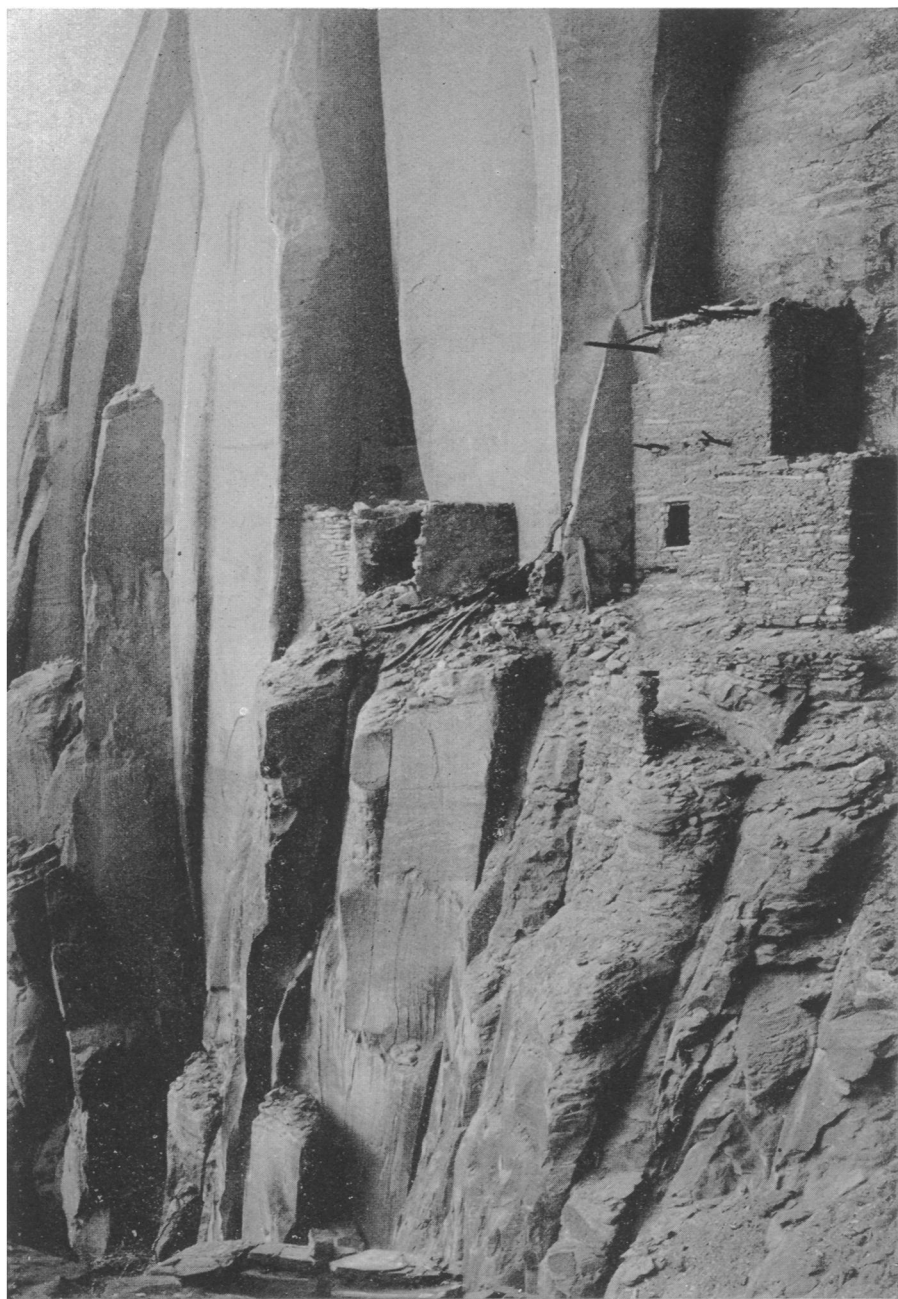


FIG. 19.—Navajos between the ages of 18 and 30 prepared for a foot race, a sport of which they are particularly fond. Note athletic build and method of protecting the hair from the wind.



Simeon Schwemberger, photo.

FIG. 20—Dinesosí, a Navajo war chief, age about 75. Navajo leaders are chosen for their intellectual capacity rather than for their physical prowess.



A. H. Townsend, photo.

FIG. 21—Ancient dwelling of the Kisani race. A cliff house of the abandoned village of Betatakin, in a branch of Tsegi Canyon.



FIG. 22.



FIG. 23.

FIG. 22—Modern house of the Kisani race; a Hopi dwelling in the village of Oraibi.

FIG. 23—Navajo summer and winter hogans. The summer house is a temporary structure built of brush over a frame of poles. The winter hogan has a strongly built frame of beams set in forked supports and is plastered over with adobe. In this view the summer and winter houses are together; usually they are far apart, since grazing lands and cornfields are in general widely separated. A hogan in which a death has occurred is "chinde," *i. e.*, a home of evil spirits, and may not be again utilized. Abandoned hogans are therefore common in the Navajo country.

turned toward the past; new conditions are met with reluctance. They have successfully resisted Christianity since the days of Coronado, and in other respects their response to the influence of missionary and Government official is negligible. Their one request is to be let alone; to spend the dying days of their race in accordance with the revered customs of their ancestors.

The Navajo, on the other hand, is tall, lithe, active, and enjoys out-of-door work and manly sports. He is independent but helpful and genial. There is nothing of the stoic in his mental make-up. He is intellectually alert and overcrowds the school accommodations. He belongs to the vigorous Athabasean stock whose branches extend from the Arctic Circle to central New Mexico. Navajo family life is clean and the position of women is probably higher than in any other uncivilized tribe. His social and political organization is based on the theory that leadership belongs by right to the wise and far-seeing. As a race the Navajos are increasing in numbers and in physical and mental strength. They look toward the future with hope (Figs. 19 and 20).

The Hopi, like his ancestors of the Kisani race, is sedentary, a village dweller and agriculturist. Through centuries of experiment he has become surprisingly skillful in selecting fields and caring for crops in a region where the white man fails. During the growing season his days are spent in working ground one, five, or even ten miles from his pueblo, to which he may return at night. Corn, beans, melons, supplemented by piñon nuts and the flesh of small desert animals constitute his food supply; and that his menu is not modern except for mutton is indicated by the presence of corn cobs, beans, and bones of various animals in ancient cliff houses. Both dry farming and flood irrigation are practiced, and that his mind is intent on water conservation is shown by the organization of clans and by the elaborate ceremonies devised to enlist the co-operation of unseen powers which are believed to control the rainfall. Endless toil and endless prayer, both designed to insure water for his corn crop, constitute the life of the Hopi. To offset failure and the ill will of the gods, Kisani houses, both ancient and modern, include a granary in which two to four years' supply of corn is stored for famine years (Figs. 21 and 22).

In marked contrast with the Hopi the Navajo is a nomad, a stockman adjusted to an arid climate. His normal place is on horseback; a walking Navajo is a rare sight. His hogan is a temporary structure of poles and mud or of brush (Fig. 23); his life consists in following his flocks from place to place where water and forage

are available. The Navajos also practice agriculture to a limited extent and camp during the growing season near the fields selected for planting. Farming, however, is a secondary consideration, and tending of sheep and weaving of blankets are the chief occupations of men, women and children of the tribe.

TABLE I—INDIAN AND WHITE POPULATION OF THE NAVAJO-HOPI RESERVATION, 1912

Agency	INDIAN POPULATION						WHITE POPULATION		
	Navajo	Hopis	Plutes	Full blood	% afflicted with trachoma	% afflicted with tuberculosis	Wear modern attire	Speak English language	
Navajo Extension..	1,200	...	...	1,200	20.83	4.08	800	75	Officials
Navajo	10,000	...	...	9,990	15.00	11.00	2,500	750	Traders
Pueblo Bonito.....	2,685	...	...	2,680	53.32	1.71	800	300	Missionaries
San Juan.....	8,000	...	...	8,000	22.00	25.00	1,000	200	
Western Navajo....	6,131	204	200	6,535	6.54	8.27	200	200	
Hopi.....	2,000	2,068	...	4,064	61.45	4.57	1,500	1,500	
Totals.....	30,016	2,272	200	32,469	18.39	12.36	6,800	3,025	
Total Indian population						32,488			521 Total white population.
									* Estimated by writer.

POPULATION AND ECONOMIC CONDITIONS

The accompanying tables of population, agriculture and stock raising, arranged with reference to the six administrative subdivisions of the Navajo country, present the significant features in the life of the present inhabitants. The small white population is wit-

ness of the fact that these native races, particularly the Navajos, have attracted the attention of the Government only during recent years (Table I). As yet the interchange of ideas between Indian and white involves the use of an interpreter. The absence of a white population and the inharmonious relations between Navajo

TABLE II—AGRICULTURE ON THE NAVAJO-HOPI RESERVATION, 1912

Agency	AGRICULTURAL LANDS										Total acres
	Irrigated acres	Irrigable but not irrigated acres	Irrigation not necessary acres	Miles of ditches	Lands cultivat- ed by Indians acres	Number of farms	Average size of farm acres	Value of crops raised \$	Grazing lands acres	Unfit for any purpose acres	
Navajo Extension.	20	500	.....	5	Not reported	Not reported	Not reported	\$ 6,000	75,000	288,340	358,860
Navajo.....	.....	10,000	.....	*	10,000	2,000	5	\$ 6,000	4,900,000	.....	5,000,000
San Juan.....	5,000	.....	.....	100	5,000	1,000	5	162,500	3,810,000	.....	3,810,000
Pueblo Bonito.....	Unkn own	.....	Unkn own	own	400	200	2	1,338	1,500,000	.....	1,500,100
Western Navajo.....	1,000	13,000	7,300	45(est.)	1,000	400	2.5	10,100	3,020,347	388,700	3,379,347
Hopi.....	10	.....	3,999	*	4,000	1,500	2.67	22,000	1,588,330	720,000	2,472,320
Total.....	6,030	23,500	11,299	200	20,400	5,100	3.43	\$201,938	14,983,667	1,342,040	16,520,627

* Navajo and Hopi together 50 miles.

and Hopi are doubtless responsible for the singular purity of the native stock. Tuberculosis and especially trachoma have gained a foothold from which they are to be dislodged only by vigorous exertion on the part of the present much undermanned medical corps.

The tables showing the uses for which the lands of the Navajo-Hopi Reservation are adapted indicate the small area to which agriculture must be confined, and also the large acreage unfit for either farming or grazing (Tables II and III). The classification of lands as given in the table, while only approximate, is believed substantially to represent existing conditions; about 40,000 acres

TABLE III—STOCK-RAISING ON THE NAVAJO-HOPI RESERVATION, 1912

Agency	Grazing lands, acres	Horses, mules, burros	Cattle	Sheep and goats	Value of all stock sold and slaughtered	Value of blan- kets sold
Navajo Extension....	75,000	1,040	1,240	25,000	\$ 7,400	\$ 7,000
Navajo.....	4,990,000	162,000 (est.)	10,000	700,000	.....	270,000
San Juan.....	3,810,000	141,000	6 000	450,000	181,250	200,000
Pueblo Bonito.....	1,500,000	10,651	10,550	146,776	.....	25,000
Western Navajo.....	3,020,347	12,200	2,500	150,000	48,200	15,000
Hopi.....	1,588,320	6,150	3,000	142,000	83,006	100,000
Total.....	14,983,667	333,041	33,290	1,613,776	\$319,856	\$617,000

out of a total of over 16,000,000 acres, *i. e.*, less than .0025 of the area, are suitable for agriculture. One-half of the farm lands is already occupied, although not utilized to its full capacity. The condition of the live-stock industry as shown in Table III indicates clearly the use for which the Indian lands are adapted. The introduction of sheep by the Spaniards was a contribution to the welfare of the natives deserving of the highest praise. The statistics presented show clearly that the economic future of the Navajo country is bound up with stock-raising rather than with agriculture. Irrigation on a moderate scale is feasible along permanent water-courses, and small parcels of land may be reclaimed by developing springs and constructing wells and rain catches, but a policy designed to improve breeds, conserve grazing, introduce new forage plants and to develop many small water supplies for stock is most likely to insure the highest usefulness for the region.

FLUCTUATION IN POPULATION

From a few small roving bands the Navajos have developed into a populous and powerful tribe since the landing of Columbus. According to their traditions the original clan was created in the San

Juan Valley about 500 years ago. People living on the earth before that time, except the Kisani, who remained hidden in their cliff houses, were destroyed by demon giants whose heads are the volcanic necks, whose bones and also weapons are the abundant logs of petrified wood, and whose blood has congealed to form lava flows. As a people they were first specifically mentioned by Zarate-Salmeron in 1629, as "Apaches de Nabaju." By the middle of the seventeenth century, through increase in population and union of families and clans, they had become sufficiently powerful to compete with adjoining tribes and their history from about 1700 to the time of the Mexican War is a record of raids on pueblos and outlying white settlements. From about 1840 to 1860 the Navajos occupied the center of the stage in New Mexico—waging constant warfare with the pueblos and the Mexican settlers. After New Mexico and Arizona came into the possession of the United States, a series of unsuccessful military expeditions directed against the Navajos culminated in the campaign of 1863. During this year Kit Carson invaded the Navajo country, killed the sheep, burned the cornfields, and took possession of water holes, thereby forcing the surrender of the whole tribe. The number of prisoners held at Bosque Rodondo was 7,300, which was believed to include the whole tribe and doubtless was 90 per cent. of all the Navajos in New Mexico and Arizona. In 1869 the Navajos were again brought to one center for the purpose of receiving sheep, allotted to each family by the Government; a careful count made at that time and including allowances for absentees, showed a population of 9,000. The census of 1890 credits the tribe with 17,204; the figure for 1900 is 20,000; by 1912 the number had increased to 30,000. The task of enumerating the members of a nomadic tribe thinly scattered over 23,000 square miles of arid and unmapped land is attended with great difficulties and the results are necessarily uncertain. There is no doubt, however, that the Navajo tribe has greatly increased in numbers during the past half-century, a fact unparalleled in the history of American Indian tribes.

The Hopis, on the other hand, have decreased in population since their discovery by the Spanish in 1540. Disregarding the wild statement of Espejo in 1583 that 50,000 Moquis lived in one village alone, the first creditable figure of Hopi population is given for 1774 by Escalante, who spent eight weeks at the Tusayan villages, and found 7,494 people of various ages, two-thirds of them at Oraibi. Governor Ansa reported in 1780 that the entire population of the Hopi pueblos was 798; 6,698 persons had died of disease and

starvation during the previous three rainless years. The official figure for 1846 is 2,450; for 1861, 2,500. The census for 1890 gives 1,996 inhabitants; for 1900, 2,004; for 1,912, 2,068; these occupied the villages of Hano, Sichomovi and Walpi on the First Mesa; Mishongnovi, Shongopovi and Shupaulovi on the Second Mesa; Oraibi on the Third Mesa; and Moenkopi in the Moenkopi Valley.

HABITABILITY OF THE NAVAJO-HOPI RESERVATION

Under present climatic conditions on the Navajo Reservation, stock-raising supplemented by agriculture is capable of supporting about two Indians per square mile without change in farm or range practice; *i. e.*, the population could be increased by one-half. Development of the water supply, protection of the grazing lands, and selection of forage and farm crops would permit the present mixed population to become 80,000 or 100,000 or about 3 per square mile. By agriculture alone probably not more than half of the present population of 33,000 could be supported on the basis of prevailing farm practice.

These observations lead naturally to the question of past habitability of the Navajo country. Could a larger population have been supported before the days of domestic animals? And did such a population occupy this region as agriculturists? Nearly all explorers and students of the Southwest point to the innumerable ruins of the ancient people as evidence of denser population in the days of the cliff dwellers. In order to support a population some hundreds of times greater than now exists in this region, more favorable conditions for agriculture must have prevailed. To meet this demand, a period of former greater humidity is assumed. As stated in a recent work:⁸

“Various lines of evidence point to progressive desiccation of the region . . . since the beginning of the pueblo and cliff dwelling period . . .”

For the Navajo Reservation the geologic evidence of periods of greater rainfall, also of lesser rainfall, or at least periods of erosion alternating with periods of aggradation, is conclusive. The evidence of recurrent periods in strength and weakness of streams, and of the accumulation and dissipation of ground water is in harmony with the wide variation in precipitation shown by the rain gages at Wingate and Fort Defiance (Fig. 6, Part I). That climatic

⁸Hewett, Henderson and Robbins: Physiography of the Rio Grande Valley, *Bur. Am. Ethnol. Bull.* 54, 1913, p. 68.

fluctuations of considerable amplitude may have occurred within the past thousand years needs only to be stated to insure belief, but that the history of the pueblos and their ancestors is proof of progressive aridity sufficient to depopulate the region is, to my mind, an assumption insufficiently supported by field evidence.

Relation of Ruins to Population. In order to extinguish a large population, a former large population must be shown to have existed. And this is done by the advocates of progressive aridity by the simple process of estimating the house room indicated by the thousands of ruined buildings. This method of reasoning involves the assumption that these ancient settlements were contemporaneous. The history of the Kisani, however, indicates that they belong to the species of migratory village dwellers. No large number of the ruins were occupied simultaneously, and houses or even villages were occupied for only part of the year. In their migrations the people stopped from time to time, building pueblos and cultivating fields. Tradition speaks of many places where groups or clans remained for five, ten, or fifteen "plantings," ample time for the construction of houses and the accumulation of potsherds. As pointed out by Fewkes,⁹ the priests of the Snake clan relate that after their ancestors had been dropped from a rainbow at Navajo Mountain they were compelled by reptiles to leave their canyon homes and that on their southern migration they built houses at stopping-places all the way from Navajo Mountain to Walpi. The numerous well-built pueblos and single buildings of the Verde Valley, now in ruins, have been shown by Mindeleff to be the result of brief occupation.¹⁰ The migration of villages in the ancient Province of Tusayan is significant in this connection (Fig. 24). None of the present Hopi villages except Oraibi occupy their sites of 1540; more than half of them date from the middle of the eighteenth century. The old villages now in ruins were in exposed situations, the pueblos of later date are perched high on precipitous capes extending southward from the desert-encircled island of Black Mesa (Fig. 25). The ancient villages were occupied in peaceful times before the coming of the warlike Navajos. In their new positions the Hopis have successfully resisted the attacks of Piute, Navajo and Spaniard. Oraibi, surrounded by vertical walls of sandstone and dominating the plain of the Tusayan washes, doubtless owes its uninterrupted history to its original strategic position. Six villages

⁹ *Bur. Am. Ethnol. Bull.* 50, 1911, p. 3.

¹⁰ C. Mindeleff: *Aboriginal Remains in Verde Valley*, *Bur. Am. Ethnol.*, 13th Ann. Rept., 1896.

at First Mesa and five at Second Mesa are now in ruins. By those unfamiliar with the historical evidence these ruins have been taken as proof of former larger population, whereas the old sites have merely been abandoned for new. In the Jadito district Awatobi, perhaps the largest of all the villages known to the Spanish explorers, was destroyed by war in 1700 and, as the chronicle runs, "the prisoners were taken to the sand hills of Mishongnovi for treatment." A few years ago the "stand pat" party of Oraibi seceded and built a new pueblo at Hotevilla.

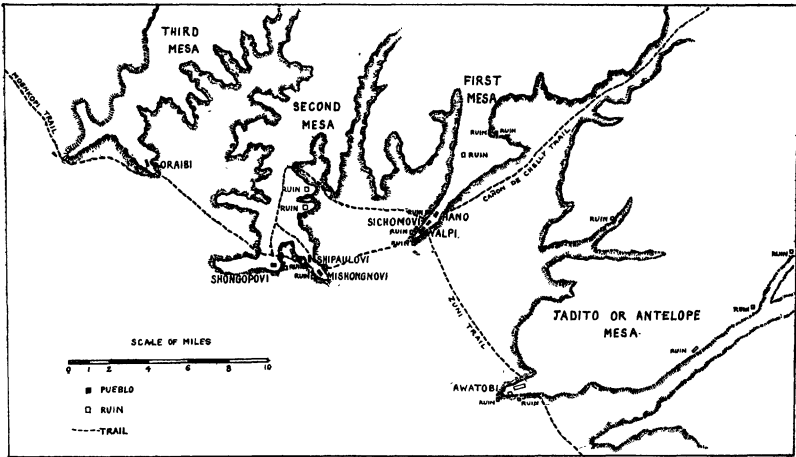


FIG. 24—Map of ancient and modern villages in the Province of Tusayan based on topographic and archeologic surveys. The villages represented by ruins are in unprotected positions, suitable locations before the advent of the Navajo but untenable during the raids of the warlike nomads.

Within a radius of ten to twenty miles from each Hopi village are a number of "suburban villas," some quite elaborate, which are occupied for four or five months each year by Indians whose fields are at a distance. For many years the well-built pueblo of Moenkopi, with rooms for 200 people, was occupied only during the growing season by farmers from Oraibi, forty miles distant. Since 1890 numerous small houses have been erected at or near springs in the foothills at some distance from the centers of population, and Fewkes¹¹ is of the opinion that children now living may see Walpi depopulated. This process of integration and disintegration of populations in response to the coming and going of hostile neighbors appears to be normal to Hopi life.

The source of the clans at Walpi and Sichomovi is interesting in

¹¹ *Bur. Am. Ethnol., 17th Ann. Rept., 1898, Part II, p. 580.*

this connection. As shown by Fewkes, two are from southern Utah, seven from the Little Colorado, six from the Rio Grande Valley and the New Mexican pueblos of Zuni, Acoma, Jemez, etc. So far as climate and water supply are concerned these immigrants did not better their conditions by coming to Tusayan.

Another feature of Hopi life, one which doubtless prevailed among their ancestors, must be taken into account in estimating

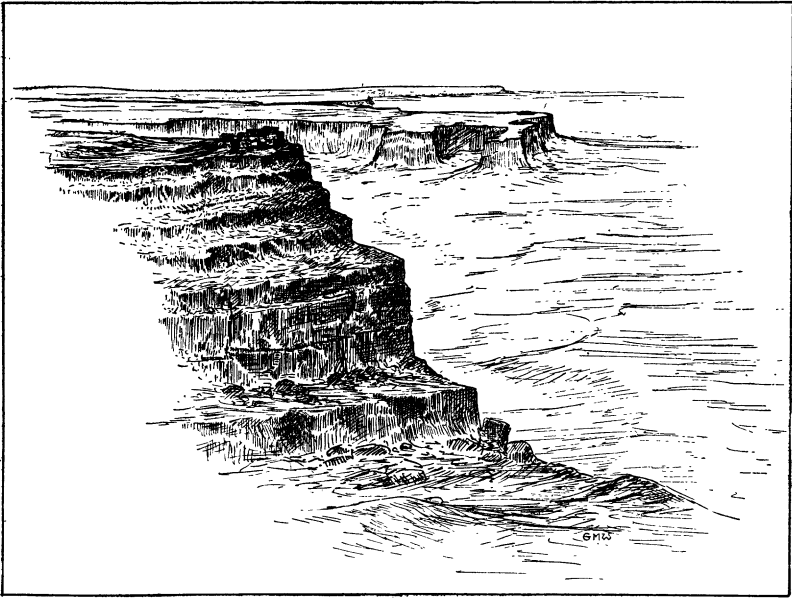


FIG. 25—Sites of the Hopi villages in the Province of Tusayan constructed from topographic surveys and measured stratigraphic sections. Oraibi is in the foreground; Shongopovi and Shipaulovi are in the middle distance; Walpi on the First Mesa is barely distinguishable in the background. The cliffs rise abruptly out of the flat floor of the Tusayan washes and project like wave-washed capes into the sands of a desert sea.

population. Houses are grouped by clans and a man at marriage goes to his wife's house. The clan with the largest number of marriageable daughters increases in size at the expense of other clans. Many new houses are thus constructed while nearby ones are left vacant. Increase in the size of a village does not necessarily indicate increase in population, and the presence of uninhabited houses is not evidence of a decrease in the number of inhabitants. The counting of rooms in ruins is not therefore a satisfactory method of arriving at the number of former inhabitants. On the basis of ruins estimates as high as 500,000 have been given for these ancient people. The figure given by Bandelier, 30,000, represents,

to my mind, about the total population of northern Arizona, southern Utah, northern New Mexico and southern Colorado, during the palmy days of Kisani life.

If progressive desiccation were responsible for the extinction of the cliff dwellers, it follows that these ancient people could not now support themselves at their former homes. The field evidence is not in harmony with this conclusion. Disregarding the necessity of protection from human enemies, the requirements of a Kisani settlement are five:

1. A sufficient number of fields with suitable slope for storm flood irrigation and with soil tillable with wooden and stone implements. This requirement is met within a small radius at all seats of ancient occupation which I have visited.

2. A small rainfall or snowfall in winter and at least one inch of rain during July or August. This summer rain is the critical factor and prayer and penance are called in to secure results. The amount of rain must not be excessive, for excessive flooding and consequent erosion is as disastrous as too little rain. These precipitation demands are met at all ruined villages with which I am acquainted except Moenkopi and those in the Little Colorado Valley and Lower Tusayan washes, where flats along the washes are well irrigated by summer flood streams.

3. A growing season long enough to mature food plants. The cliff and plateau villages are limited to regions where the growing season exceeds 100 days. The higher and better-watered but colder parts of the reservation were not occupied until after the introduction of sheep.

4. A food plant adapted to arid regions. Hopi corn meets this demand. This plant is peculiarly adjusted to arid conditions and as handled by the Indians needs only the summer rain or an equivalent amount of water artificially applied to bring it to maturity. It thrives in desert washes and even in sand dunes. A typical Hopi corn field is not an attractive sight. The corn stalks are short and the plant expends little energy in producing leaves; yet it is vigorous and productive (Figs. 26 and 27). Perhaps the most remarkable feature of the corn is its response to deep planting,—an essential in arid climate agriculture. In digging up hills of Hopi corn it was found that the seed had been planted six to twelve inches below the surface, where even during the dry spring months the soil is moist and germination assured. Quantitative experiments made by the Bureau of Plant Industry show that the mesocotyl of Hopi corn

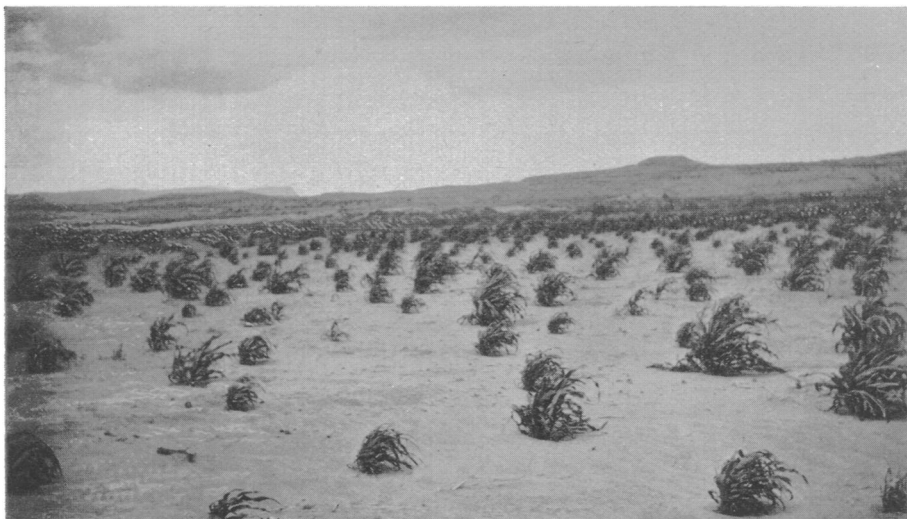


FIG. 26.



FIG. 27.

G. N. Collins, photo.

FIG. 26—Typical field of Hopi corn. The seed is deeply planted along desert washes and sandy slopes and depends on rain flood irrigation to reach maturity.

FIG. 27—Single stalk of Hopi corn. One to four ears grow on each of these short stalks. The energy of the plant is expended in producing roots and seed with little attention to superfluous foliage.

attains lengths of ten or even twelve inches whereas two to four inches is normal for common varieties¹² (Fig. 28).

5. Water for domestic use. The amount need not be large, but must be permanent and capable of protection. Flowing water on the Navajo Reservation is scarce, but springs which have been known to outlast three continuous years of drought are fairly numerous. For many years no permanent water was found at certain large ruins, but belief in its existence has led to its discovery at several places. At Burro Springs a good supply was found by trenching sand dunes. In Jadito Wash an ancient spring was recovered by removing talus; and at one of the largest ruins in Arizona, Kinteel or Wide Ruin, whose source of water was long unknown, excavation revealed a well which now furnishes water for 1,000 head of sheep in addition to supplies for a trading post.

In view of these facts, I see no reason why the present Hopis in numbers equal to the probable population of these ancient settlements could not succeed as agriculturists in the homes of their ancestors.

In fact there is a well-authenticated tradition that a colony of Hopis, about 1750, re-occupied the abandoned fields and cliff houses of Canyon de Chelly.

It is interesting in this connection to note that the geographic conditions which controlled the location of settlements of the ancient Kisani race exert the same influence on the modern Indians, both Hopi and Navajo, and also guide the white man in his efforts to make the Navajo country more habitable. As shown on the map

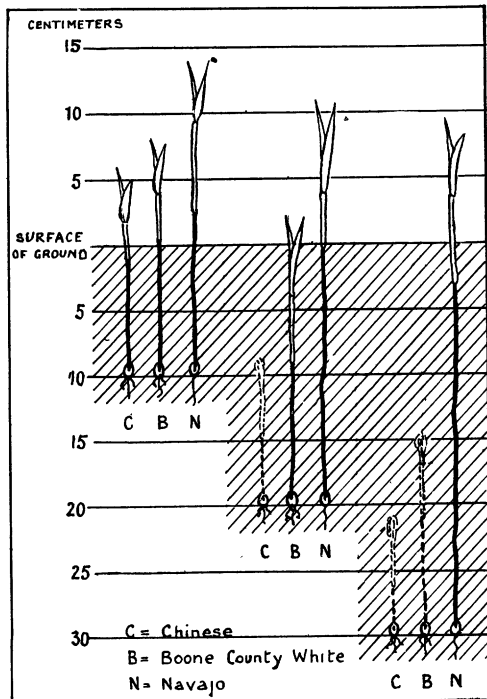


FIG. 28.—Diagram showing the root habit of Hopi corn as compared with other varieties, indicating a remarkable adaptation to arid conditions.

¹² G. N. Collins: Pueblo Indian Maize Breeding, *Journ. Heredity*, Vol. V, 1914, No. 6.

(Fig. 29) the thickly populated areas during the days of the cliff dweller are the centers of population of the Navajo and also are the areas which are best adapted for settlement by the whites.

With reference to decrease and increase of tillable acreage and the change in location of fields, the habit of streams of the Navajo Reservation needs to be taken into account. At the present time

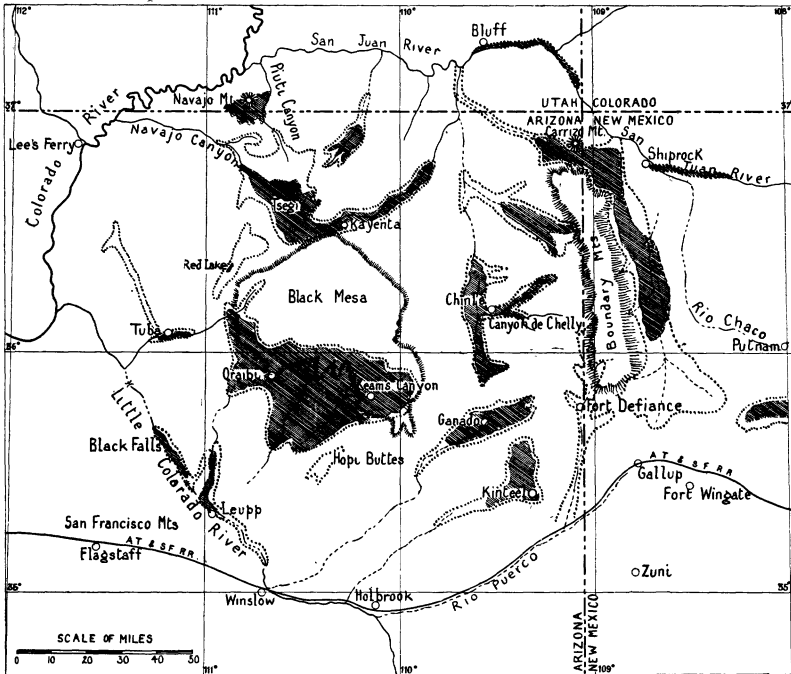


FIG 29—Sketch map showing the positions of fields cultivated by the Kisanis race of the cliff dweller period in relation to areas now suitable for cultivation. The areas shaded by diagonal lines include abandoned fields and ruins: between dotted lines are enclosed areas suitable for agriculture and partly utilized by the present Hopis and Navajos.

the streams are actively entrenching themselves in an older valley fill. Practically every canyon and wash on the Navajo Reservation is traversed by an inner canyon with alluvial walls (Fig. 30). This change in stream habit from filling to trenching has occurred within recent times. In 1850 Simpson camped at a pond near Fort Defiance in a valley now thoroughly drained. The peat beds on the margin of three lakes in Tsegi Canyon, mapped by H. M. Wilson in 1883, are about 20 feet above the present valley floor. In several other valleys similar conditions were noted. The cutting of the alluvial-walled canyon at Moenkopi has taken place since the Mor-

mon occupation in 1878. The accounts of Indians, traders, and Government officials agree in placing the beginning of vigorous erosion at about 1885. Without considering at this time the factors responsible for this change of stream habit, two geographic results may be pointed out:

1. The number of perennial streams has been increased and their surface flow augmented. More water is available for irrigation by diversion, and a larger number of reliable watering places for stock has been provided. It is interesting to note that strata containing corn cobs, broken pottery, and remnants of ancient gardens are exposed in the banks of these newly made channels, indicating occupation during periods of aggradation and erosion alike.

2. Many fields, including some of the best agricultural land on the reservation, have been destroyed. The allotting agent for the Hopi Reservation estimates that 10 per cent. of the land cultivated by the Hopis in 1890 had been destroyed by 1910. This figure may be used as representative for the entire Navajo country.

The response of the Hopi and Navajo farmers to these changed conditions is suggestive. Many fields in the valleys were gradually deserted and the adjoining summer dwellings abandoned. New fields on the higher slopes were selected, and ancient plots on inter-stream spaces far removed from their present homes were reoccupied. Judging from the amount of pottery, some of these farms had been cultivated for long periods in olden times and the state of the ruins and the age of brush now occupying the fields indicate that they may have lain idle for 50 or 100 years. Other fields were selected in places where flowing water, revealed by recent erosion, afforded opportunity for irrigation directly from streams. At Moenkopi, where the supply of water has greatly increased, the temporary settlement has become a permanent, thriving village (Fig. 31). It is probable that the history of the Kisani includes a number of such episodes which involved readjustment, but not depopulation. The acreage now under cultivation, on the Navajo Reservation, so far as determined, has not decreased as the result of the changes during the past 30 years.

CONCLUSION

The Navajo country is a virgin field of geographic research; only reconnaissance work has as yet been undertaken. So far as present observations extend there is scant evidence of fundamental changes in the physical environment during the past six or eight centuries. Detailed studies may result in a different conclusion, and lead to

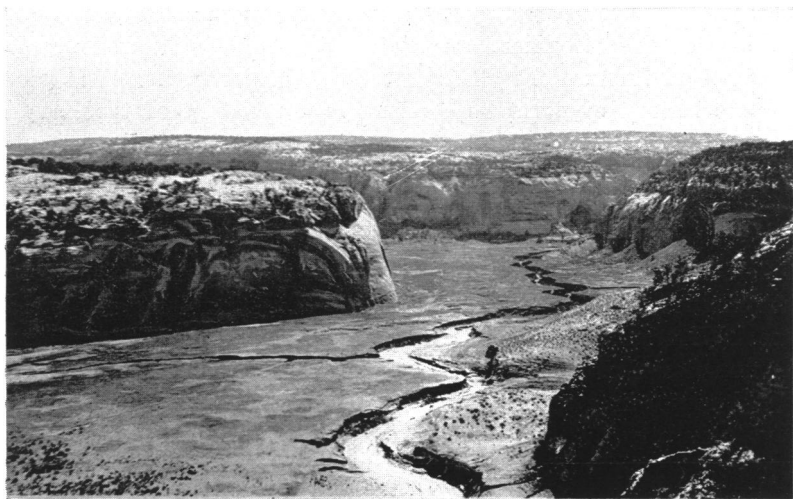


FIG. 30.

C. R. Jefferis, photo.



FIG. 31.

FIG. 30—View of Tsegi Canyon as seen from its rim. The walls are of red sandstone 600 feet in height. The flat floor is formed of alluvium 20 to 50 feet thick, into which an inner valley has been cut to depths of 10 to 30 feet.

FIG. 31—The Hopi village of Moenkopi with adjoining cornfields. For a century previous to about 1885 this site was intermittently occupied by a few Hopi farmers from Oraibi; the present population is 225. Reoccupation of these long-abandoned farm lands was favored by two factors: protection from roving bands of Piutes and Navajos and increase in supply of available water.

the establishment of long cycles of unfavorable climatic conditions in place of the recognized alternating favorable and unfavorable short-period fluctuations characteristic of arid regions. The geographic history of northern Arizona is the history of the Kisaní race. Many details of this history are recorded, but its large features and its dominant controls are as yet unknown. The problem is comparable to that presented by the Incas of Peru and is, I believe, to be solved by methods adopted for that work: a long period of field study of the geographic history of the region carried on in the presence of the ruins and assisted by the descendants of the old race. With suitable maps at hand, two years' field study among the unmolested ruins and uncharted terraces of Rainbow Plateau should result in a valuable contribution to the geography of the Navajo country.*

* Reference should also be had to the note on the Navajo Indians under "Geographical Record" in this number.—ED.

CLIMATIC SUBDIVISIONS OF THE UNITED STATES

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In dealing with the climatology of an area as large as that of the United States, we must, if our discussion is to be clear and systematic, adopt some scheme of subdivision into climatic districts, or provinces. Many suggestions have already been made along this line, and Mr. W. L. G. Joerg has recently done a useful piece of work in bringing together reproductions of the most important classifications of the "natural regions" or provinces of North America and of the United States.¹ Twenty-one different schemes are presented. Eight are grouped as *structural*, 4 as *climatic*, 2 as *vegetational*, 1 as *zoogeographic*, and 6 as *natural regions*. In addition, Mr. Joerg gives a new classification in which he has selected what seems to him best in the others.

Of the climatic classifications included by Mr. Joerg, those of

¹ W. L. G. Joerg: "The Subdivision of North America into Natural Regions: A Preliminary Inquiry." *Annals Assoc. Amer. Geogr.*, Vol. IV, 1914, pp. 55-83. Also gives references to other classifications not especially considered in the article. It adds greatly to the convenience of the reader that one scale of map is used for all the North American classifications, and one scale for all those dealing with the United States.